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IS 9331 (1979): Laboratory methods for determination of elastic properties for alpine skis [PGD 27: Mountaineering Equipment]

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Indian Standard

LABORATORY METHODS FOR DETERMINATION OF ELASTIC PROPERTIES FOR ALPINE SKIS

Mountaineering Equipment Sectional Committee, EDC 76; Ski Equipment Subcommittee, EDC 76 : 2 [Ref : Doc : EDC 76 (3321)]

1. Scope — Lays down laboratory measurement methods for the elastic properties of alpine skis. Its purpose is to determine the resistance of defined parts of the ski to bending and torsion.

1.1 In case laboratory measurement data are determined and published by the ski manufacturer or other institutions, standard measurement procedures are recommended to ensure comparability. It is not the purpose of this Indian Standard to evaluate the measurement data with regard to their influence on the quality of the ski.

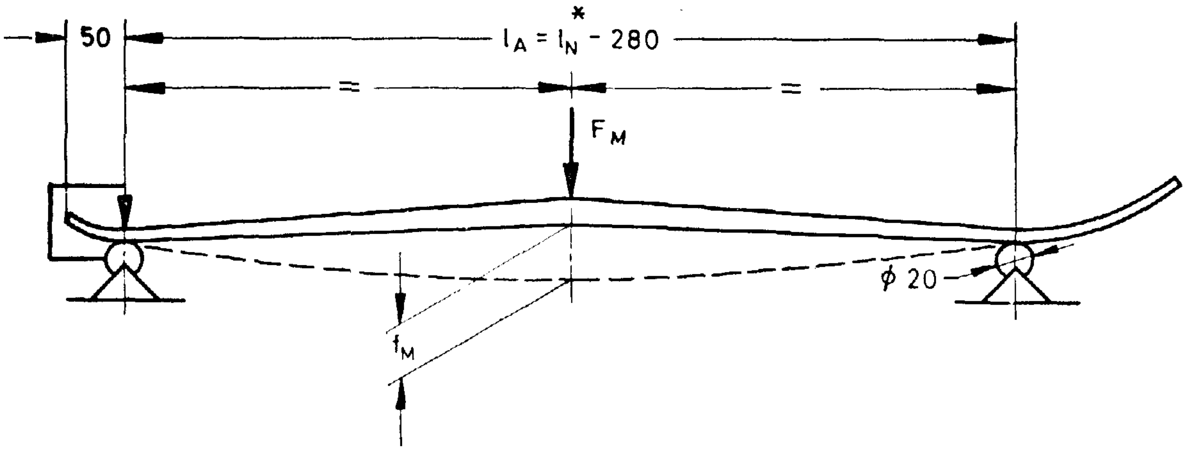
2. Definitions

2.1 *Bending Characteristics*

2.1.1 *Spring constant, c* — The ratio, expressed in newtons per centimetre, of the force *F* applied to the ski to the corresponding deflection *f*:

$$c = \frac{F}{f}$$

2.1.2 *Centre spring constant, c_M* — The spring constant determined according to Fig. 1, the ski being placed on two supports and the force F_M being equal to 300 N.



*l_N = Nominal length.

All dimensions in millimetres.

FIG. 1 DETERMINATION OF CENTRE SPRING CONSTANT

2.1.3 *Shovel spring constant, c_S* — The spring constant determined on the ski clamped according to Fig. 2.

Adopted 28 November 1979

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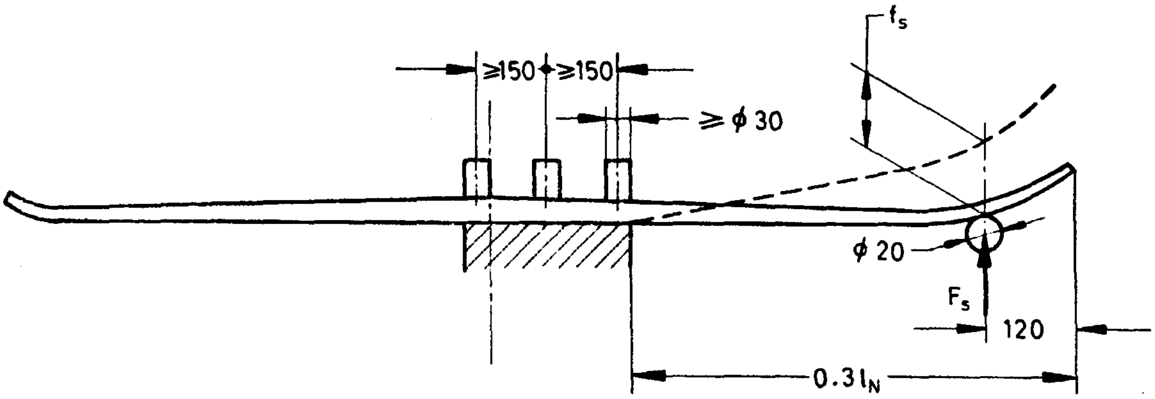
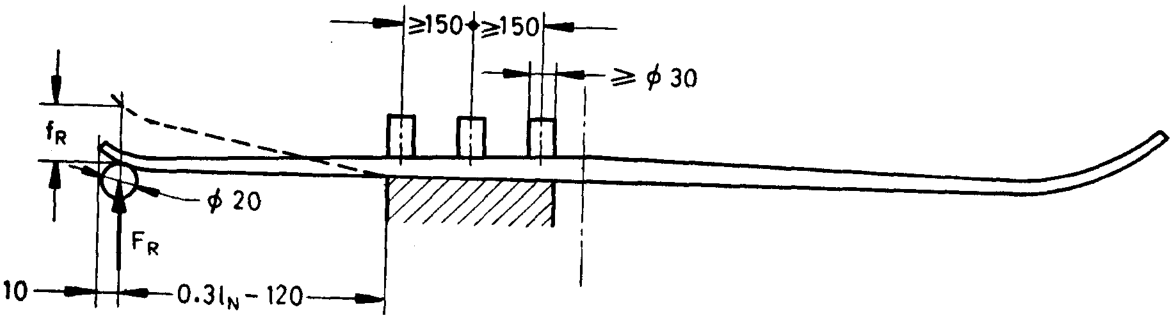


All dimensions in millimetres.

FIG. 2 DETERMINATION OF THE SHOVEL SPRING CONSTANT

2.1.4 *Rear spring constant*, c_R — The spring constant determined on the ski clamped according to Fig. 3.



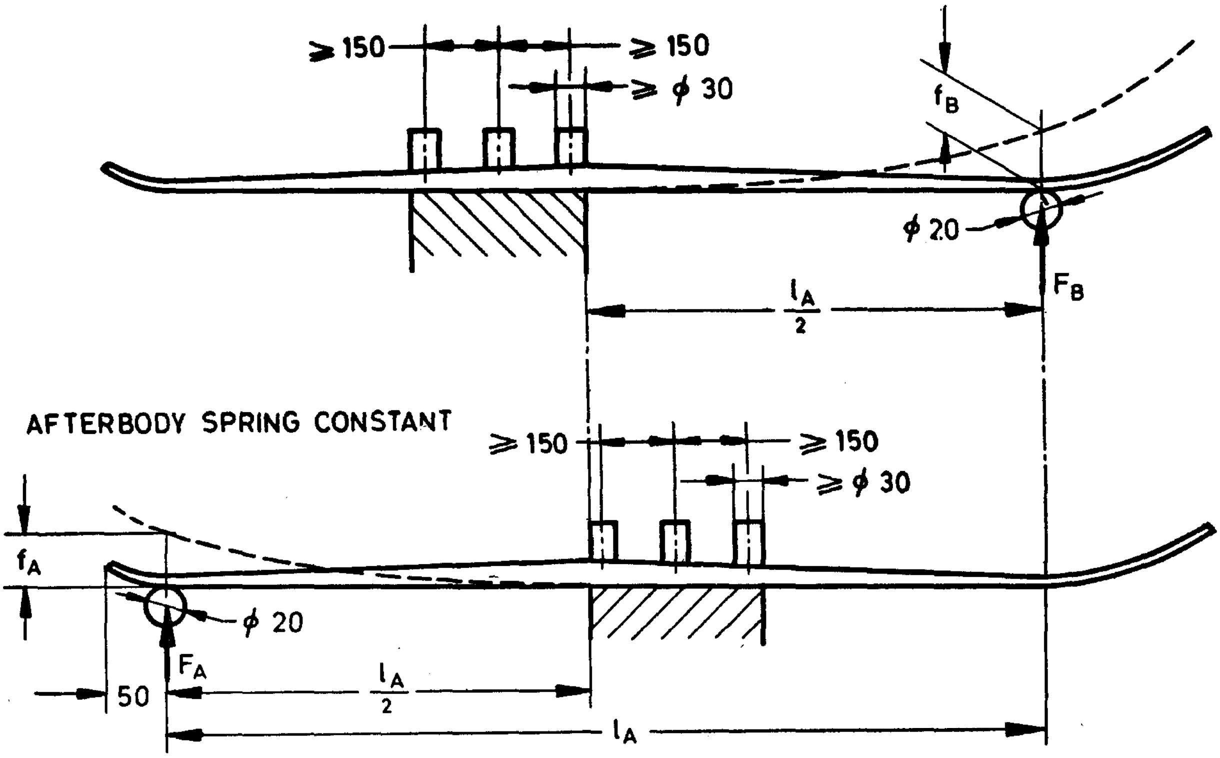
All dimensions in millimetres.

FIG. 3 DETERMINATION OF THE REAR SPRING CONSTANT

2.1.5 *Afterbody spring constant*, c_A — The spring constant determined on the ski clamped according to Fig. 4, the force F_A being equal to 50 N.

2.1.6 *Forebody spring constant*, c_B — The spring constant determined on the ski clamped according to Fig. 4, the force F_B being equal to 50 N.

2.1.7 *Spring constant balance*, B — The ratio of the afterbody spring constant to the forebody spring constant.



All dimensions in millimetres.

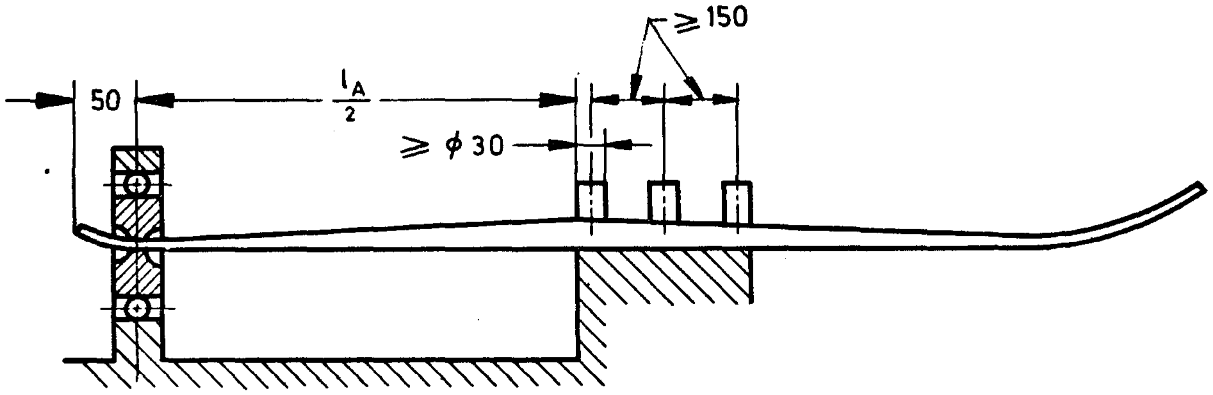
FIG. 4 DETERMINATION OF THE SPRING CONSTANT BALANCE (FOREBODY AND AFTERBODY SPRING CONSTANT)

2.2 *Torsion Characteristics*

2.2.1 *Torsional spring constant*, c_T — The ratio, expressed in newtonmetres per degree, of the torque applied to the ski to the corresponding torsion angle:

$$c_T = \frac{M_T}{\alpha}$$

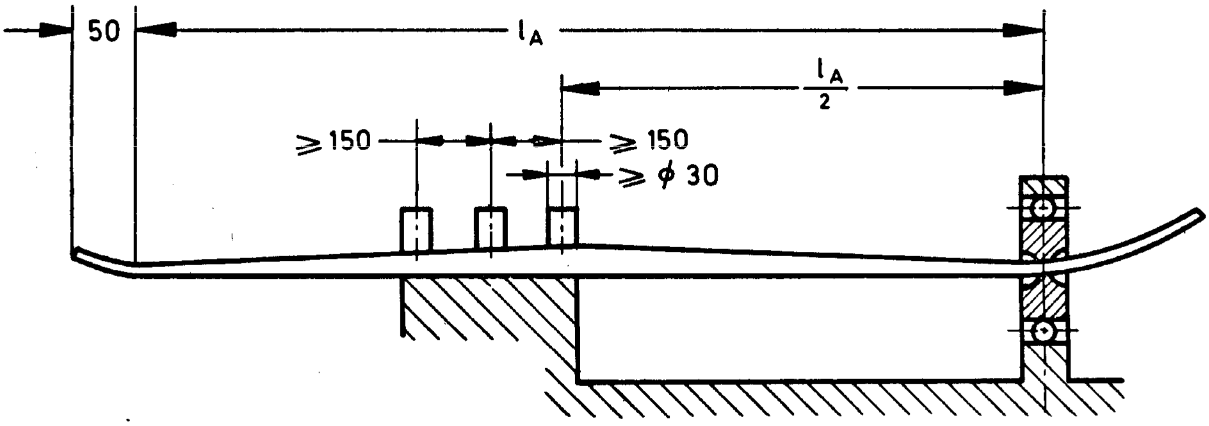
2.2.2 *Forebody torsional spring constant*, c_{TS} — The torsional spring constant determined on the ski clamped according to Fig. 5.



All dimensions in millimetres.

FIG. 5 DETERMINATION OF FOREBODY TORSIONAL SPRING CONSTANT

2.2.3 *Afterbody torsional spring constant*, c_{TR} — The torsional spring constant determined on the ski clamped according to Fig. 6.



All dimensions in millimetres.

FIG. 6 DETERMINATION OF AFTERBODY TORSIONAL SPRING CONSTANT

3. Sampling and Conditioning

3.1 *Sampling* — In order to ensure comparability it is recommended to use one of the following ski sizes:

150, 180 or 200 cm.

From these three sizes the one which is most representative for the tested model shall be selected for determination of measurement data.

All measurement shall be taken from a finished manufactured ski without any mounted parts.

3.2 *Conditioning* — All measurement shall be carried out on a ski which has been conditioned at a temperature of 23 ± 5°C for at least 2 h.

4. Determination of Bending Characteristics

4.1 *Apparatus*

4.1.1 The apparatus for measuring the centre spring constant shall include:

a) two supports with low-friction rollers of 20 mm diameter. One of these rollers shall be maintained at a distance of 5 cm from the rear end of the ski, acoording to Fig. 1;

b) a load application device mid-way between the supports, with an accuracy of at least ±2 N; and

c) a deflection measurement device with an accuracy of at least 0 05 cm.

4.1.2 The apparatus for measuring the other bending characteristics shall include:

a) a clamping fixture to grip ski, in the manner of a vice, with a flat jaw and three clamps with at least 150 mm centre-spacing between them. Clamps shall be at least 30 mm wide, covering the width of the ski;

b) a load application device with a low-friction roller of diameter 20 mm and covering the width of the ski, with a load accuracy of at least ±2 N;

c) a low-friction sled for the load application device, to ensure loading perpendicular to the centre axis of the ski at a constant distance between load application point and clamping plate; and

d) a deflection measurement device with an accuracy of at least 0·05 cm.

4.2 *Procedure*

4.2.1 *Centre spring constant* — Place the supports at distance l_A, which is the nominal length l_N minus 28 cm. Place the ski on the supports and clamp at the end. Apply a pre-load of 20 N. Load the ski quasistatically* with the test-load of $F_M = 300$ N. Read the deflection f_M, in centimetres, caused by the test-load F_M within 2 to 5 seconds after test-load application.

4.2.2 *Shovel spring constant* — Place the clamping fixture and the load application roll at a distance of $0{\cdot}3\ l_N - 12$ cm (*see* Fig. 2). Clamp the ski with the clamping fixture at a projected distance of 12 cm between ski tip and load application roll. Apply a pre-load of 20 N. Load the ski quasistatically* with the test-load of $F_s = 150$ N†. Read the deflection f_s, in centimetres, caused by the test-load F_s within 2 to 5 seconds after test-load application.

4.2.3 *Rear spring constant* — Place the clamping fixture and the load application roll at a distance of $0{\cdot}3\ l_N - 12$ cm (*see* Fig. 3). Clamp the ski with the clamping fixture at a projected distance of 1 cm‡ between the ski tail and the load application roller. Apply a pre-load of 20 N. Load the ski with the test load of $F_R = 150$ N†. Read the deflection f_R within 2 to 5 seconds after the test-load application.

4.2.4 *Spring constant balance* — Place the clamping fixture and the load application roll at a distance of $l_A/2$. The clamping point for the afterbody spring constant as well as for the forebody spring constant is $\frac{l_A}{2} + 5$ cm from the tail (*see* Fig. 4). Mount the ski on the clamping plate in such a way that the ski afterbody or ski forebody can be bent freely from the clamping point. Apply a pre-load of 20N. Load the sky with the test-load of F_A or $F_B = 50$ N. Read the deflection f_A or f_B caused by the test-load F_A or F_B within 2 to 5 *s* after test-load application.

4.3 *Expression of Results*

4.3.1 The centre spring constant, expressed in newtons per centimetre, is given by the formula:

$$c_M = \frac{F_M}{f_M}$$

4.3.2 The shovel spring constant, expressed in newtons per centimetre, is given by the formula:

$$c_s = \frac{F_s}{f_s}$$

4.3.3 The rear spring constant, expressed in newtons per centimetre, is given by the formula:

$$c_R = \frac{F_R}{f_R}$$

4.3.4 The spring constant balance is given by the formula:

$$B = \frac{f_B}{f_A}$$

5. Determination of Torsional Characteristics

5.1 *Apparatus* — The apparatus for measuring the torsional characteristics shall include:

a) a clamping fixture to grip the ski, in the manner of a vice, with a flat jaw and three clamps with at least 150 mm centre-spacing between them. Clamps shall be at least 30 mm wide, covering the width of the ski;

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*This means the rate of deflection is less than 20 mm/min.

†If the deflection is more than 5 cm, the load should be reduced to 100 N.

‡For skis with high tail turn up, the load application point is found by determining the point of the running surface which is 5 mm above a flat standing surface and 1 cm ahead from the point.

b) a torsion head of low friction with a clamping fixture which holds the running surface at the same level as the clamping fixture for the centre of the ski (*see* Fig. 7); and

c) a scale to read the torsion angle (or the torsional spring constant) with an accuracy of 0·5°.

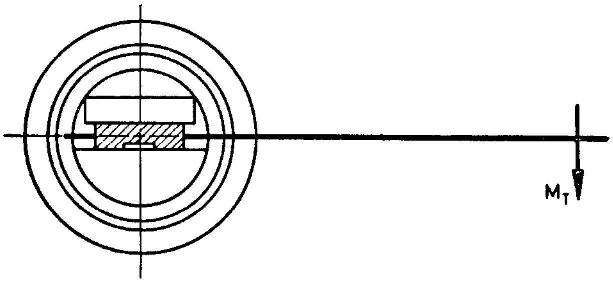

FIG. 7 TORSION HEAD

EXPLANATORY NOTE

This standard is in conformity with ISO/DIS 5902 ' Alpine skis — Determination of elastic properties — Laboratory methods ' issued by International Organization for Standardization (ISO).

Printed at New India Printing Press, Khurja, India